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SOY BEAN VARIETIES.

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 98.

B. T. GALLOWAY, *Chief of Bureau.*

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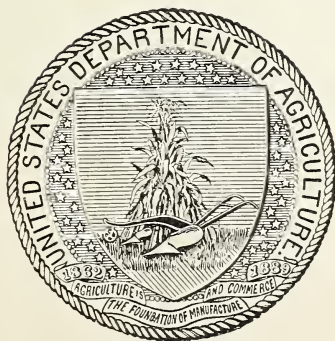
# SOY BEAN VARIETIES.

BY

CARLETON R. BALL,  
AGRONOMIST, GRAIN INVESTIGATIONS.

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## LETTER OF TRANSMITTAL

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U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF PLANT INDUSTRY,  
OFFICE OF THE CHIEF,  
*Washington, D. C., December 14, 1906.*

SIR: I have the honor to transmit herewith and to recommend for publication as Bulletin No. 98 of the series of this Bureau the accompanying manuscript, entitled "Soy Bean Varieties."

This paper was prepared by Mr. Carleton R. Ball, now Agronomist in the Grain Investigations of this Bureau, as the result of four years' investigations under the direction of the Agrostologist.

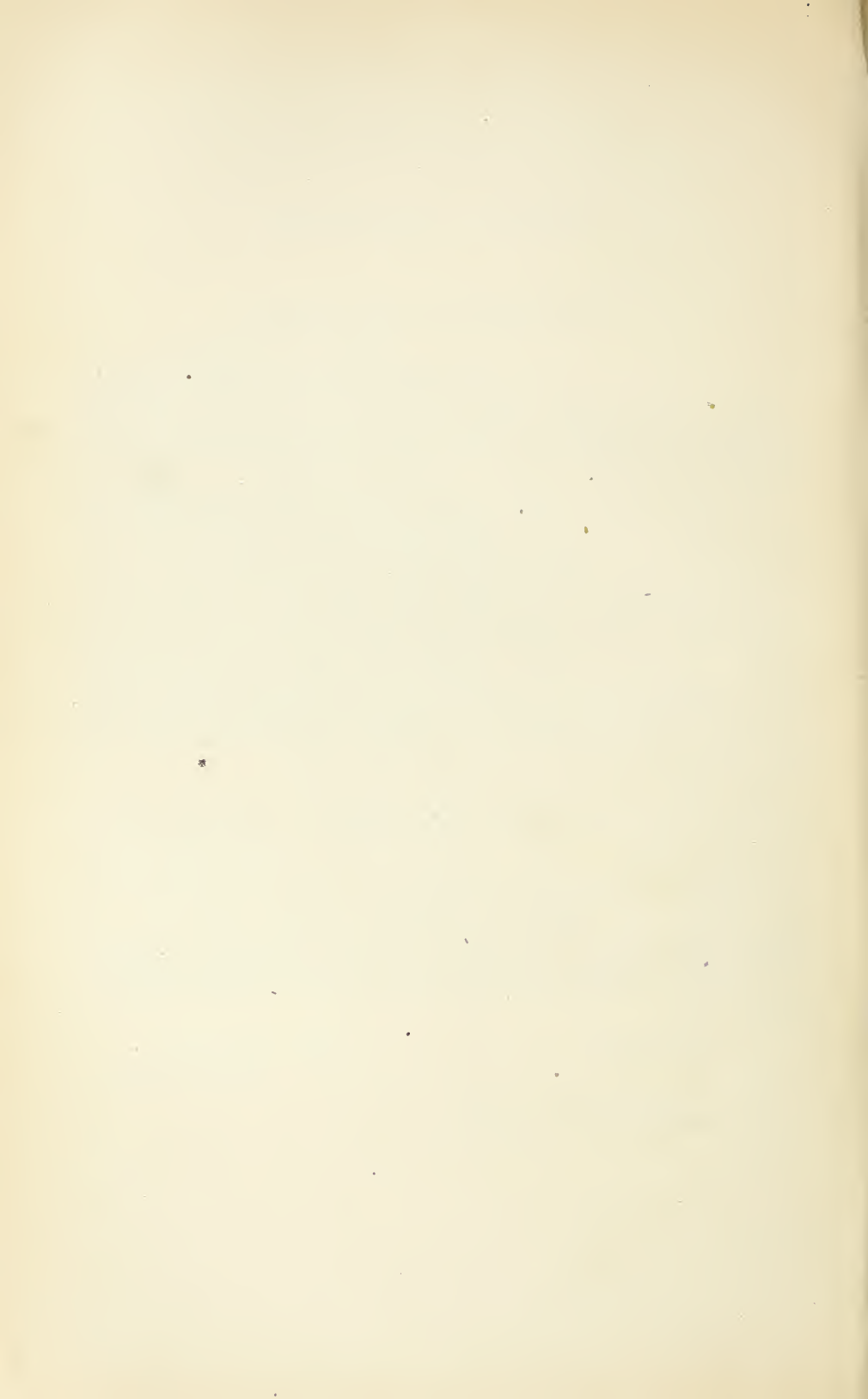
Soy beans have become an important crop in only a few localities in the United States, but in cases where farmers have learned how to utilize them to best advantage they have proved to be a crop of high value. They are especially valuable for mixing with corn for silage, for the production of hay, and for use as pasture, especially for hogs. They possess an advantage over cowpeas in that the growth is erect, and they are therefore easily harvested. Some of the taller sorts may be harvested with an ordinary grain binder.

One reason why soy beans have not become more prominent in American agriculture has been the impossibility of securing seeds of a particular variety. In this bulletin Mr. Ball has given an accurate description of each of the varieties, and where a suitable name has not already been attached to a variety a name is suggested. It is hoped that these varieties may pass into the trade under the names given in this bulletin, so that in the future farmers may be able to obtain from seedsmen the particular kind of soy bean which they wish to plant.

Respectfully,

B. T. GALLOWAY,  
*Chief of Bureau.*

HON. JAMES WILSON,  
*Secretary of Agriculture.*



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## SOY BEAN VARIETIES.

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### ORIGIN AND INTRODUCTION OF THE SOY BEAN.

The soy bean (*Glycine hispida* (Moench.) Maxim.) is an annual leguminous plant from the Orient. Its native home is said to be from southern Japan southward through eastern China and Indo-China to Java. In China and Japan it has been in cultivation for many centuries, certainly since before the beginning of the Christian era. In those countries it is easily the most important legume grown, and in some provinces it is the most important of all crops. Owing, perhaps, to the almost complete isolation of that part of the Orient, its cultivation spread only slowly to other lands. It is now grown to some extent in India, but its introduction there seems to be of recent date. It reached Europe probably in the latter part of the eighteenth century, and its arrival in England is credited to 1790. For several decades it was grown merely as a curiosity in botanic and private gardens. Investigation of the economic value of this plant began more than thirty years ago in Europe, rather earlier than in this country, but the soy bean has not yet attained any great prominence there.

The soy bean has been known in the United States for more than three-quarters of a century. In the *New England Farmer* of October 22, 1829, Thomas Nuttall wrote of its possibilities as a crop for this country. For many years it was grown only in gardens as a curious plant from the Far East. The Perry expedition to Japan in 1853 brought back two varieties, a yellow and a red sort, which were tested here in a limited way.

During the last twenty years the soy bean has been the subject of many experiments to determine its agricultural value and adaptations. The agricultural experiment stations of Kansas and Massachusetts were pioneers in these investigations and seed was imported directly from Japan by both stations. Through these efforts considerable interest was aroused, and two or three varieties soon became available commercially. The number of forms and varieties in this country was further increased by additional importations made by enterprising seedsmen. Since 1898 the Office of Seed and Plant

Introduction of the United States Department of Agriculture has secured from seven different countries of the old world no less than 65 different lots of soy bean seeds, representing about twenty varieties.

Other experiment stations and some seedsmen and private investigators have also been at work on this crop, and the number of real or supposed varieties has increased very rapidly in this country during the past few years. This general introduction of a new and little-known crop naturally resulted in much confusion concerning the names and characters of the different varieties. In many cases disappointment and loss have been caused to the grower by the lack of this information, and a really valuable crop has been brought into disfavor in some localities.

It is the purpose of this paper to describe and classify all obtainable varieties in such a way as to make them and their adaptations recognizable to farmers, seedsmen, and agricultural experimenters.

### VARIABILITY.

The varieties described in the following pages are, of course, not botanical varieties, but agricultural forms, differing in color and size of seeds, in height and habit of plant, and in earliness and lateness of maturing. All these characters, except the color of the seed, vary greatly with the climate and soil. The variation between the products of two different years at the same place is frequently very striking. Every agricultural worker is familiar with the phenomena resulting from sowing southern-grown seed of various crops in the North, and vice versa. In the case of the soy bean, observation shows that the plant reaches a state of equilibrium usually in the second generation, and almost certainly in the third generation.

In the case of imported seeds, where the habit of the parent plant and the conditions under which it grew are generally unknown, it is naturally difficult to tell when equilibrium has been reached. It is certain that many of these imported forms are much smaller in size and of earlier maturity the first year in this country than they are the second year. Some have been discarded at experiment stations after one year of trial as "too dwarf to have any value here," when subsequent trial has shown them to be decidedly large and prolific. Some have not shown their true value until the third year, and perhaps not wholly even then. In some of these importations the variation year by year has been so striking as to arouse a suspicion that the plants are not the same as those of the preceding crop. Such, for example, is *Agrostology* No. 1299 (see *Hollybrook*), a yellow soy received from France and first grown in 1902. In that year it reached a height of 12 to 16 inches and ripened in ninety-five days, being classed as a "dwarf early yellow." In 1903 it reached 24 to 28 inches

in height and required one hundred and twenty days to reach maturity, and was therefore called a "medium yellow." In 1905 the average height was 30 to 36 inches and one hundred and thirty to one hundred and forty days were needed to reach the mature condition, thus placing it with the "medium late yellow" variety Hollybrook, where it remains. While this is the most extreme case recorded, those somewhat less extreme are quite common.

Considerable variation is frequently noticed in the size of the seeds of a given variety. As might be supposed, the pods and seeds produced on plants dwarfed by drought, thick planting, etc., are generally smaller than those produced on normal plants. In a given season the average size of the seeds may be markedly different from that of the preceding or succeeding season. The seeds from pods produced late in the season are very likely to be noticeably reduced in size.

Most of the different numbers listed under the varieties described have been grown for three years, exclusive of the very unfavorable season of 1904. Some later arrivals have been studied but two years. Bearing in mind, therefore, the range of variation which may be expected and the causes which incite it, the writer can scarcely hope that no errors of classification have been made. He can only trust that whoever pursues this subject far enough to prove such errors will be in a position to understand and overlook them.

The facts stated will explain why such wide range is given in the tables and the descriptions to the average height and the average time required by any variety to reach maturity. Neither the minimum nor the maximum extreme is given in most cases, but rather the limits observed under fairly favorable circumstances. In the region lying between latitude  $37^{\circ}$  and  $43^{\circ}$  north and east of the ninety-seventh meridian (the west line of Minnesota and Indian Territory) soy beans are at their best in this country. There they are finding their most prominent and useful place in the agricultural system. In the Gulf region and on the Plains their height is likely to be much reduced, although the seed yield may not be impaired. The reduction in size is often accompanied by earlier maturity. In the Northern States the height reached may be even greater than that specified, but the seed yields are likely to be small and the growing period prolonged, at least until our varieties are more completely acclimated in those States.

#### CLASSIFICATION.

The first separation of the numerous forms or agricultural varieties of this species will naturally be through the colors of the seeds. The varieties having seeds of the solid colors black and yellow are by far the most numerous and the most striking. The greens

and browns are much less common and are also very variable in shade. The browns are of various shades of reddish brown and are also closely related to the mottled group. The yellows vary commonly into greenish shades, and any line drawn between the yellow and greenish yellow is only arbitrary. The yellows also vary into paler shades, and some have even been called "white" in Japan. This is most noticeable in old seeds, but is never carried farther than a pale yellow. It seems likely that none of the legumes commonly cultivated in Japan can have pure white seeds, like our navy beans for example, or the term "white" would never be applied to a pale-yellow form. All yellow soy beans turn gradually paler with age for at least three or four years, although some varieties are originally paler than others. Although the black group shows more variation in

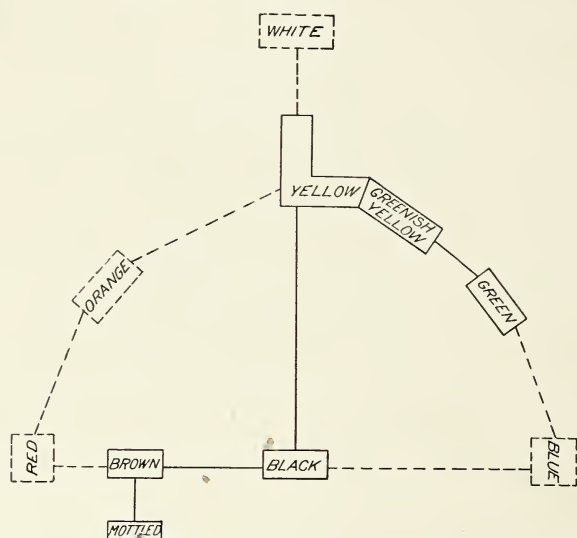


FIG. 1.—Diagram showing the probable relationships of the different groups of soy beans.

the size of the seeds, the yellow is much more variable in color shades and passes into green by some very fine gradations. There seem to be no other characters correlated with seed colors, so that this separation must be made on color alone.

Figure 1 shows an attempt to represent graphically the relationships and importance of the various color groups. The solid lines and rectangles represent existing groups and probable relationships; the dotted lines and rectangles indicate possible but still unknown groups or those toward which variation seems to be progressing. The six color groups recognized and described herein are as follows:

- |                      |                            |
|----------------------|----------------------------|
| I. Black seeded.     | IV. Green seeded.          |
| II. Brown seeded.    | V. Greenish yellow seeded. |
| III. Mottled seeded. | VI. Yellow seeded.         |



## KEY TO THE VARIETIES.

It is hoped that the following key will prove useful to those seeking to identify varieties of soy beans. The user is cautioned, however, against placing complete dependence upon the key alone. It should be used only in connection with (1) the table showing average ripening period and average height, (2) the illustrations of seeds and pods, and (3) the fuller notes and descriptions given in the body of the text. From the very nature of these so-called varieties of an agricultural crop they can not be separated by as minute characters as avail in the case of botanical forms.

## I. BLACK SEEDED.

1. Seeds large, 8 to 11 mm. long, round or broadly elliptical, pods  $1\frac{1}{2}$  to 3 inches long.
  - A. Very early, ninety-five to one hundred days, 18 to 24 inches high, short branched; leaves large, dark; pods 2 inches long or over, seeds spherical or broadly elliptical and somewhat flattened..... *Buckshot*.
  - B. As above, but seven to ten days later, branches longer, pods and seeds somewhat smaller ..... *Nuttall*.
  - C. Late, one hundred and twenty to one hundred and thirty days, about 30 inches tall, branches long, seeds very large, elliptical, much flattened. *Flat King*.
2. Seeds small, 4 to 6 or 7 mm. long, round or broadly elliptical, pods about 1 inch long.
  - A. Medium, one hundred and ten to one hundred and fifteen days, low, 15 to 18 inches tall, scarcely branched, seeds spherical or slightly flattened. *Kingston*.
  - B. Medium late, one hundred and fifteen to one hundred and twenty days, 20 to 26 inches tall, long-branched, seeds elliptical, distinctly flattened. *Ebony*.
3. Seeds medium, elongated,  $5\frac{1}{2}$  to 7 mm. long, about two-thirds as wide, much flattened.
  - A. Very late, 3 to  $4\frac{1}{2}$  feet tall, very much branched, leaves and pods small. *Riceland*.

## II. BROWN SEEDED.

1. Early, pods over  $1\frac{1}{2}$  inches long, seeds large, 8 to 9 mm. long, round, or nearly so.
  - A. Very early, about 20 inches high, branches few and short..... *Ogemaw*.
  - B. Early, about 22 inches high, branches very numerous and longer ..... *Eda*.
2. Medium late, 25 inches tall, long branched, pods less than  $1\frac{3}{8}$  inches long, seeds small, 4 to  $6\frac{1}{2}$  mm. long, spherical or round.
  - A. Pods distinctly flattened,  $\frac{3}{8}$  to  $\frac{1}{2}$  inch or over in width, seeds deep brown, shining..... *Baird*.
  - B. Pods nearly cylindrical,  $\frac{1}{8}$  inch or less in width, seeds light brown, dull. *Brownie*.

## III. MOTTLED SEEDED.

1. Identical with Riceland, except in color of the elongated seed..... *Hankow*.
2. Plant not known, seeds large, nearly round ..... *Meyer*.

## IV. GREEN SEEDED.

1. Early, low, 15 to 20 inches, short branched, pods slender, commonly 3 seeded, seeds light green, elongated..... *Samarow*.
2. Medium, one hundred and ten days, 30 inches tall, pods broader, seeds round, deep green..... *Guelph*.

## V. GREENISH YELLOW SEEDED.

1. Early, very low, 14 to 18 inches, pods about  $1\frac{1}{4}$  inches long, seeds medium large, roundish or broadly elliptical, hilum pale brown..... *Yosho*.
2. Medium late, about one hundred and twenty days, 25 to 30 inches high, branches long, pods and seeds as the last, but hilum deep brown ..... *Haberlandt*.
3. Late, one hundred and thirty days or over, 35 inches or over in height, very long branched, pods  $1\frac{1}{2}$  inches long, seeds larger, round or elliptical, hilum scarcely tinted..... *Tokyo*.

## VI. YELLOW SEEDED.

1. Much-branched plants, branches as long as the main stem; pods small to medium, 1 to  $1\frac{1}{4}$  inches long, often 3 seeded, seeds medium,  $5\frac{1}{2}$  to 8 mm. long, round or broadly elliptical, flattened, mostly deep yellow.
  - A. Early, about ninety-five days, 18 to 24 inches tall..... *Ito San*.
  - B. Medium late, one hundred and twenty to one hundred and twenty-five days, 25 to 30 inches tall..... *Hollybrook*.
  - C. Later, one hundred and twenty-five to one hundred and thirty-five days, taller, 32 to 42 inches..... *Mammoth*.
2. Early, low, about 20 inches, scarcely branched, pods larger, seeds 7 to 9 mm., broadly elliptical, yellow, slightly greenish, hilum brown ..... *Manhattan*.
3. Low, stocky, somewhat branched, pods large, seeds large, 7 to 9 mm., spherical or slightly flattened, pale yellow, hilum yellow or pale brown.
  - A. Medium early, one hundred to one hundred and five days, about 20 inches tall, branches short ..... *Butterball*.
  - B. Medium late, one hundred and twenty to one hundred and twenty-five days, a little taller, branches nearly equalling stem ..... *Amherst*.

Figure 2 shows the average number of days required by each variety from date of seeding to the ripening of the crop and also the average height in inches which the plant attains. The longer, more slender line indicates the range of variation in different seasons and at different stations. It does not, in most cases, show the extremes caused by exceptionally favorable or exceptionally unfavorable conditions. The shorter, heavily shaded line indicates the average performance of the variety under average conditions. Probable exceptions, as in the case of Ogemaw, are noted in the descriptions of the varieties.

## DESCRIPTIONS OF THE VARIETIES.

## BLACK-SEEDED GROUP.

## BUCKSHOT.

The Buckshot is a well-known commercial variety, having been on the market in this country for a number of years. So far as known, it is the only variety with black seeds which is obtainable commercially. It is quite generally sold by northern seedsmen and under several descriptive names, all more or less similar, as Black, Early Black, Medium Early Black, Extra Early Black, Large Black, etc.

It is a rather low and stout, stocky plant, with short branches and large, very dark leaves. The height is medium, varying from 15 to 28 inches,<sup>a</sup> with the average from

<sup>a</sup> The figures given for height indicate the total height of plant, including the upper leaves.

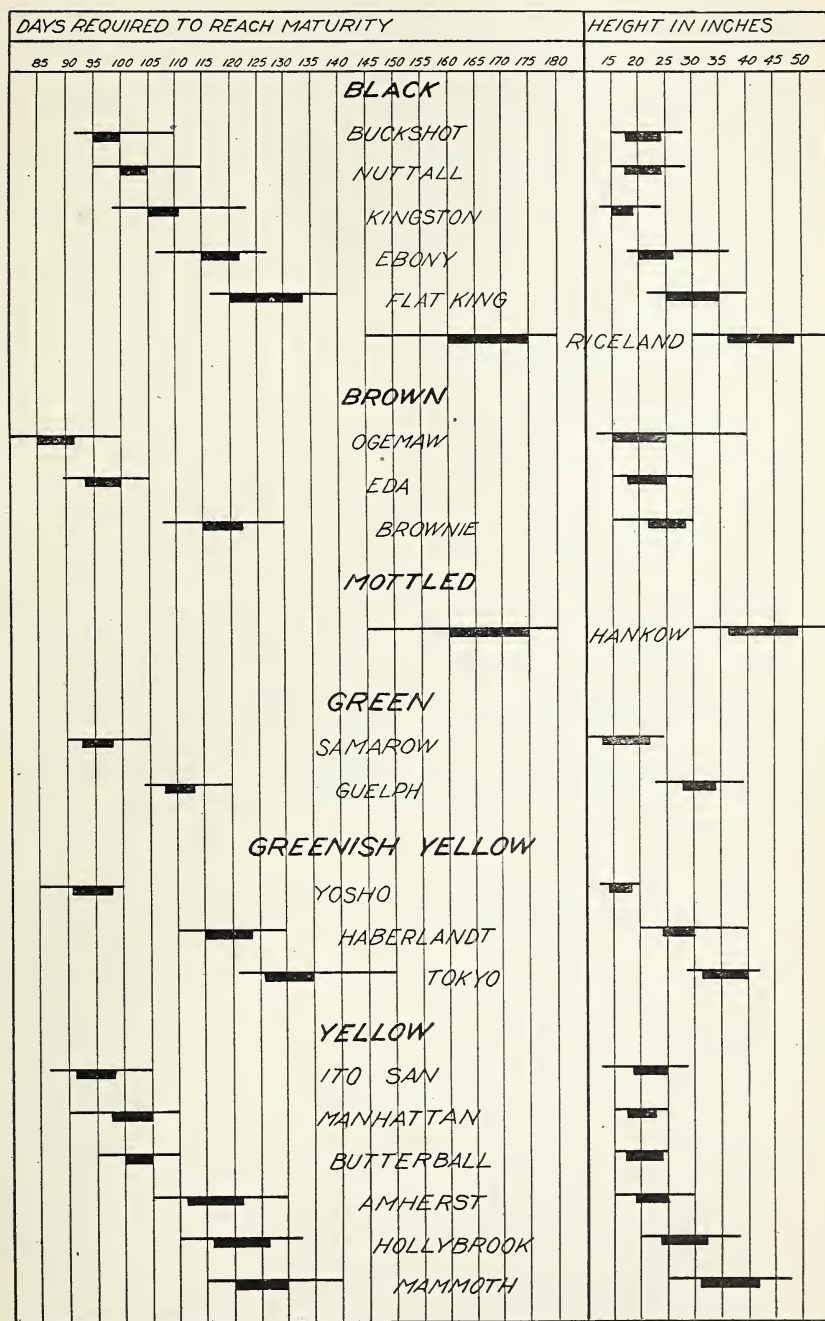


FIG. 2.—Diagram showing for each variety of soy bean the number of days required to reach maturity and the height of the plant in inches. The averages are shown by extra heavy lines.

18 to 24 inches. The stems are of medium thickness, measuring from one-eighth to one-third inch in diameter at the base, with a few (3 to 6) short, appressed branches quite near the ground. On vigorous plants these branches will occasionally be 6 to 10 inches<sup>a</sup> in length. The leaves are large, very dark green in color, broad, and often blunt at the apex. The pods are 2 to 3 seeded, usually 2 seeded, 2 to 3 inches long, one-half inch wide, set very thickly on the short branches and main stalk near its base, often so low as to make harvesting difficult. The seeds are jet black and shining, but usually covered with a powdery bloom, which gives them a dull and grayish, or leaden, color. They are large, 8 to 11 mm. long by 8 to 9 mm. wide, round or very broadly elliptical in lateral view, somewhat flattened when seen in the dorso-ventral view. Seeds from luxuriant vines in moist soil are likely to be somewhat larger and flatter, with the black seed coat wrinkled and sometimes split open.

Although quite widely cultivated in the lower parts of the Northern States, this variety has never become very popular in that section. This seems to be largely due to the fact that the Guelph (medium green), while averaging only ten days later in maturing, also averages 10 inches taller, and is thus considerably more valuable. The Buckshot requires from ninety-two to one hundred and ten days to reach maturity, the average for most locations being ninety-five to one hundred days. It does not mature in the most northern States except in favorable seasons, and then is likely to require about one hundred and twenty days to reach maturity. The name, Buckshot, was suggested by the size, shape, and color of many of the seeds.

*Numbers and sources of lots grown.*—Agrost. No. 1184, "Black," R. I. Agric. Expt. Station; Agrost. No. 1292, S. P. I. No. 6334, Japan; Agrost. No. 1301, "Early," Johnson & Stokes; Agrost. No. 1303, "Extra Early Black," J. M. Thorburn & Co.; Agrost. No. 1304, W. A. Burpee; Agrost. No. 1471, "Extra Early Black," J. M. Thorburn & Co.; Agrost. No. 1474, "Extra Early Black," Hammond Seed Company; Agrost. No. 1978, union of Agrost. Nos. 1184, 1301, 1304, 1471; Agrost. No. 1979, union of Agrost. Nos. 1292, 1303, 1474; Agrost. No. 2033, "Black," Ark. Agric. Expt. Station; S. P. I. No. 6334, "Round Black," Japan; S. P. I. No. 8491, grown from No. 6334; S. P. I. No. 9412, grown from No. 6334; S. P. I. No. 11179, "Early Black," source not known; S. P. I. No. 17251, union of Agrost. Nos. 1978, 1979, 2033, and S. P. I. No. 11179.

#### NUTTALL.

This variety is closely related to the Buckshot, but is distinguished by smaller seeds and rather stouter and more branching plants. The stems are stout, from one-third to one-half inch in diameter at the base, and ranging from 15 to 28 inches in height, with the average between 17 and 24 inches. The plants are usually well branched and the branches spreading, nearly closing the spaces between 3-foot rows on good soil. The leaves are large and medium green in color. The pods are 2 to 3 seeded, but rather more than usual contain 3 seeds each, and occasionally there is one with four seeds. From 2 to 4 pods are borne on each peduncle. The pods are medium, about 2 inches long, one-fourth to three-eighths inch wide, often not turning brown until after the seeds are ripe. The pods do not dehisce readily, commonly remaining closed until the seed is fully ripe. The seeds are jet black and shining, with usually little or no powdery bloom, medium to large in size, 7 to 9 mm. long, 6 to 8 mm. wide, round or broadly elliptical in outline from a lateral view, distinctly flattened from the dorso-ventral view. The Nuttall requires from one hundred to one hundred and fifteen days to ripen its seeds, the average time being one hundred and five to one hundred and ten days. This variety has apparently but very little to recommend it. It is later than the Buckshot, and, though well branched, the total height is not increased,

<sup>a</sup> The figures given for the length of branches are for the naked branch only. With leaves attached the branches are from 7 to 9 inches longer.



so in that respect it can not compare with the Guelph variety. In seed yields, where sown thickly enough to make fair forage, it has not done much. From 4 to 6 bushels to a little more than 12 bushels to the acre are the recorded outputs.

The name is given in honor of Thomas Nuttall, who wrote the first recorded account of the soy bean in this country.

*Numbers and sources of lots grown.*—Agrost. No. 1536, S. P. I. No. 6416; S. P. I. 6416, "Black," from Korea; S. P. I. No. 8496, grown from S. P. I. No. 6416; S. P. I. No. 9418, grown from S. P. I. No. 8496; S. P. I. No. 17253, grown from Agrost. No. 1536-1.

#### KINGSTON.

This is a small, medium early variety, with rather slender stems, one-eighth to three-eighths inch in diameter at the base, and 12 to 24 inches high. The average height is 16 to 18 inches. The stems are either unbranched or with three to six short appressed branches at the base, 1 to 2 inches long. The general color of the foliage is from a medium to dark green, and the leaves are large and less pointed than in Ebony. The pods are very small, averaging smaller than those of Ebony, three-fourths to 1 inch in length and one-fourth inch in width, 2 to 3 seeded, borne very thickly on the main stem, often to within 2 inches of the ground. The full-grown but still unripe pods bear a strong resemblance to young peanut pods, being cylindrical and considerably constricted between the seeds. The seeds are the smallest of any black variety, and are equalled in smallness by the Brownie only. They are entirely round in outline, no long diameter being discernible,  $4\frac{1}{2}$  to 6 mm. broad, jet black and shining, with only a slight bloom, and only moderately flattened in dorso-ventral view.

This variety is too small and unbranched to have much value for forage. It is likely to prove a fairly good yielder of seed, two tests sown thickly for forage having yielded between 8 and 9 bushels of seed per acre. In time of ripening it is medium early, requiring from one hundred and four to one hundred and twenty-two days, or averaging one hundred and ten to one hundred and fifteen days.

The name, Kingston, is given in honor of the Rhode Island Experiment Station, located at Kingston, R. I. That station has contributed largely to our knowledge of the soy bean as a crop for northern regions, and this variety was received from that source alone.

*Numbers and sources of lots grown.*—Agrost. No. 1188, "Japanese No. 15," R. I. Agric. Expt. Station; S. P. I. No. 17255, grown from Agrost. No. 1188-1.

#### EBONY.

The very small-seeded variety known as Ebony is not to be had on the market, and it has apparently been obtained abroad but once. The original importation was from Ping-yang, Korea. In size of seed and pod it is, with the exception of Kingston, the smallest of all the black soy beans and one of the few very small-seeded varieties of any color.

The Ebony variety is characterized by rather slender stems, one-eighth to one-fourth inch in diameter at the base and 18 to 36 inches tall, erect, and usually well branched. The branches are long and slender, spreading at an angle of about  $45^\circ$ , thus giving the plant a very bushy habit. The leaves are small to medium in size, averaging  $1\frac{1}{2}$  to  $2\frac{1}{2}$  inches long, and are medium green in color. A good crop of pods is borne on stem and branches alike. The pods are very small, three-fourths to 1 inch in length by one-fourth inch in width, each containing 2 or rarely 3 seeds. The seeds are small, jet black, shining, with scarcely any trace of bloom, round to broadly elliptical in outline, mostly the latter, 5 to  $6\frac{1}{2}$  or 7 mm. long,  $4\frac{1}{2}$  to  $5\frac{1}{2}$  or 6 mm. wide, rather

more variable than in the other black varieties, quite distinctly flattened in dorso-ventral view.

The growth the first season was small but plants of the second and third generations were 18 to 36 inches high, according to locality. This variety closely resembles the Nuttall in habit of growth, but is much later in maturing and has very much smaller pods and seeds. It has, apparently, the bad habit of not holding its leaves well until the pods are ripe, and it is not likely to be regarded as of value unless that fault is eliminated by selection. As a hay crop, designed to be cut before fully mature, it would do very well. The other characters, such as slender stems, fair height, and long, slender branches, as well as a good crop of pods, all mark it as of probable value for hay. It requires from one hundred and seven to one hundred and twenty-seven days to reach maturity, the average being from one hundred and fifteen to one hundred and twenty-two days.

The name has reference to the color of the seeds.

*Numbers and sources of lots grown.*—Agrost. No. 1193, S. P. I. No. 6386; Agrost. No. 1541, S. P. I. No. 8492; Agrost. No. 1980, Agrost. Nos. 1193 and 1541, united; S. P. I. No. 6386, "Black," Korea; S. P. I. No. 8492, grown from S. P. I. No. 6386; S. P. I. No. 9414, grown from S. P. I. No. 8492; S. P. I. No. 17254, grown from Agrost. No. 1980.

#### FLAT KING.

The Flat King is a tall and quite stout variety, with stems one-half inch in diameter at the base, often branching quite freely, 20 to 30 inches high in drier regions, 30 to 40 inches in more favorable localities. The branches are 5 to 7 in number, the lower ones 10 to 14 inches long, the upper 4 to 8 inches, ascending or spreading, nearly meeting across the spaces between rows 3 feet and more apart. The leaves are large, abundant, and medium to dark in color. This variety bears usually a heavy crop of pods, but these are commonly quite close to the ground, making harvesting rather difficult, especially where the plants are low. The pods are large, 2 to 2½ inches long, one-half inch wide, usually loosely 2 seeded. The seeds are larger and flatter than those of any variety, jet black, shining, with little or no bloom, flat, broadly elliptical in outline, 7 to 9 mm. wide, 8 to 12 mm. long, a common size for well-developed beans being 8 by 11 mm., only 3½ to 4 mm. thick, occasionally somewhat pointed at the ends.

The Flat King is a very strong-growing variety, resembling the Nuttall more closely than any other black-seeded form, though the Flat King is the taller, its average height being from 25 to 35 inches. It is not a commercial variety yet, but its heavy crop of pods, its large size, and branching habit make it a valuable variety for trial as a silage crop or for a cover crop or hog pasture, especially in the Southern States. It is later than any of the large and promising varieties, except the Tokyo, and is more comparable with the Mammoth in time of maturity, requiring from one hundred and seventeen to one hundred and forty days or even more in unfavorable seasons. Yields of seed of from 6 to 9 bushels to the acre have been recorded.

The name is given on account of the much flattened seeds and the large size of seeds and plants.

*Numbers and sources of lots grown.*—Agrost. No. 1293, S. P. I. 6312; S. P. I. No. 6312, "Flat Black," Japan; S. P. I. No. 8497, grown from S. P. I. No. 6312; S. P. I. No. 9410, grown from S. P. I. No. 8497; S. P. I. No. 17252, grown from Agrost. No. 1293-2.

#### RICELAND.

This is one of two very peculiar varieties imported from China. These two, the Hankow being the second one, are very similar in habit, differing only in the color of the seeds. They are, however, quite different from all other varieties studied. In appearance they scarcely suggest the familiar type of soy beans. Where sufficient moisture may be had they attain the greatest height of any varieties yet grown.

The main stem is stout at the base, one-fourth to one-half inch in diameter there, but soon becomes reduced in size and flexuous or somewhat twining in habit. It is then no longer distinguishable from the larger branches. The entire plant reaches a height of from 3 to 5 feet. The long slender branches spring abundantly from the whole length of the stem. They frequently equal or even exceed the main stem in length, and are themselves repeatedly branched. The long lower branches are inclined to become prostrate unless the rows are close enough together to give some support one to another. The tips of the branches become actually twining and often tangle themselves together. The leaves are very small, only 1 to 2 inches in length, narrow, medium green to light green in color. The pods also are very small, scarcely 1 inch long by about one-fourth inch wide. They are scattered quite uniformly over the long stem and branches. The seeds are medium small and elongated in proportion to their width, jet black, shining, the original seed so heavily coated with powdery bloom as to obscure the ground color entirely, the generations grown in this country much less thickly covered, narrowly elliptical, 4 to 5 mm. wide,  $5\frac{1}{2}$  to 7 mm. long, a common size being  $4\frac{1}{2}$  by  $6\frac{1}{2}$  mm., very much flattened, only  $2\frac{1}{2}$  to 3 mm. thick.

The Riceland has not yet been placed on the market. It is known only from the original importation from beyond Chiu Niu, near Hankow, province of Hupeh, in the great valley of the Yangtze, China, where it is sown in July or August, between the rows of rice. It ripens late in the fall after the rice is harvested. It is thus accustomed to very wet soils. In the trials made in this country it has required from one hundred and fifty to one hundred and eighty days to reach maturity. It is probable, however, that if treated here as in China, viz, planted late in wet ground, it would still come to maturity before frost, at least in the South, and in a considerably shorter period than if sown earlier. Its numerous slender branches, fine foliage, and tall growth are indicative of great value as a hay plant. It does not do well at all in dry regions and should be tested only on moist or wet soils. It is worthy of very careful trials under these conditions.

S. P. I. No. 16790 from Hangchow, China, is probably another lot of this striking variety. This lot has not been grown by the writer, but it is characterized by the same narrowly elliptical, flattened seeds. They average slightly larger than those just described, some reaching 5 by 8 mm. Hangchow is also in the rice-growing section of China.

The name, Riceland, is suggested by the use of this variety by the Chinese in their rice fields.

*Numbers and sources of lots grown.*—Agrost. No. 964, S. P. I. No. 6560; S. P. I. No. 6560, from beyond Chiu Niu, near Hankow, China.

## BROWN-SEEDED GROUP.

### OGEMAW.

The Ogemaw soy bean has recently been brought to public notice and put on the market by Mr. E. E. Evans,<sup>a</sup> of West Branch, Mich., as an extra early form for northern latitudes. The writer has had it under test for only one season, that of 1905. In all trials made, mostly in the middle South and Southwest, it has shown itself to be a dwarf and stocky early variety. Since the well-known effect of sowing northern-grown seed in the South is to check its vegetative vigor for at least one season, it may be assumed that the Ogemaw is likely to have a greater average height than it reached

<sup>a</sup> Mr. Evans spells the name "Ogema," which is likely to prove confusing in pronunciation to those unfamiliar with the name. Prof. C. D. Smith, director of the Michigan Experiment Station, states that the name was derived from the county "*Ógemaw*," and the writer prefers the longer spelling as being more likely to be correctly pronounced.



last year, which was only 10 to 20 inches. In Upper Michigan it has been reported to have an average height of 38 inches, which is well toward the other extreme. It is likely that further trials will prove the Ogemaw identical with the next variety, Eda, except perhaps in time of ripening.

The Ogemaw soy bean has stems of medium size, one-fourth to three-eighths inch in diameter at the base, freely branching, with short and usually appressed branches 2 to 4 inches long, thickly set with brown pods,  $1\frac{1}{2}$  to 2 inches long, three-eighths to one-half inch wide, 2 to 3 seeded, usually becoming brown before the seeds are ripe, and with an unfortunate tendency to shatter easily, even before fully mature. The seeds are large and plump, round or very broadly elliptical in outline, 8 to 9 mm. long, 7 to 9 mm. wide, somewhat flattened in cross section. In color they are a deep brown when mature. Before maturity they are light brown. A sample is likely to contain seeds in various stages of ripeness, and hence to present all shades of brown in color, sometimes on a single seed. Stored seed becomes darker with age. Mature seeds are commonly quite shiny. The Ogemaw is one of our very earliest varieties, ripening in from eighty-two to one hundred days, with the average somewhere about eighty-eight to ninety days. It has not shown itself a specially heavy yielder of seed, due partly to the early dehiscence of the pods and shattering of the seeds.

*Numbers and sources of lots grown.*—Agrost. No. 1992, "Ogemaw," E. E. Evans, Mich.; Agrost. No. 2031, "Crossbred No. 6," Ark. Agric. Expt. Station; S. P. I. No. 13502, Agrost. No. 1992; S. P. I. No. 17258, grown from Agrost. No. 1992; S. P. I. No. 17259, grown from Agrost. No. 2031.

#### EDA.

The Eda variety is very similar to the Ogemaw and is likely to prove identical with it when the Ogemaw has become more fully acclimated and has regained its normal size. The Eda differs from the Ogemaw variety chiefly in its greater height, longer branches, and in being a week or so later in maturing. In short, it is a larger and more vigorous plant, which the Ogemaw is likely to equal in another trial with home-grown seed.

The Eda is a medium-sized, well-branched plant, from 16 to 30 inches high, branches 6 to 12, more numerous than in any other small variety, the lower ones 6 to 10 inches long, erect appressed, and therefore not giving the plant a bushy appearance. Stems and branches podded well, but not too close to the ground; pods  $1\frac{1}{4}$  to  $1\frac{3}{4}$  inches long, three-eighths to one-half inch wide. Fairly early, maturing in from one hundred to one hundred and ten days. The seeds are almost identical with those of Ogemaw, round or broadly elliptical, 7 to 9 or 10 mm. long by 7 to 9 mm. broad, deep brown, shiny, but usually covered with more or less powdery bloom, which gives them a dull appearance.

The plat of this variety grown at the Tennessee Experiment Station in 1905 had foliage of a most striking and peculiar coppery-green color not observed in any other plat.

The name, Eda, is a part of the longer name under which this variety was received.

*Numbers and sources of lots grown.*—Agrost. No. 1185, "Brown Eda Mame," R. I. Agric. Expt. Station; S. P. I. No. 17257, grown from Agrost. No. 1185-1.

#### BAIRD.

The seed of this variety was mixed with the original and only importation of the Brownie variety, described later. In all the brown varieties, except the Brownie, the seeds are deep brown when ripe, but light brown when nearing maturity. For this reason the light brown seeds of the Brownie and the deep brown seeds of the Baird varieties were thought to represent the immature and mature seeds, respectively, of a single variety, which was called Brownie.

The Baird variety is readily distinguished from the Brownie by its slightly larger and more flattened deep brown seeds. The pods also are distinctly larger and more flattened, three-eighths to one-half inch or more in width,  $1\frac{1}{2}$  to  $1\frac{3}{4}$  inches in length, apparently remaining nearly yellow at maturity.

The characters of the plant have not been recorded, but it is probably coarser and less branched, though earlier, than that of the Brownie variety. From the Ogemaw and Eda varieties it is separated by its smaller pods and much smaller seeds. It is probably much like them in habit, but longer branched and later.

As this variety was separated from the Brownie after the plates were prepared, its name does not appear on Plate III. It is, however, represented by the two left-hand seeds in No. 9 on Plate I and by the four left-hand seeds and the lower pod attributed to the Brownie variety on Plate III, as noted in the description of the plates.

The variety is named for Rev. W. M. Baird, a missionary, who secured the seed in Korea.

#### BROWNIE.

This is a well-branched, bushy variety, with very small pods and seeds. It is not known commercially, but only through the original importation from Korea.

The stems are medium in size, one-fourth to three-eighths inch in diameter at base, bearing 3 to 6 branches, the lowermost 15 to 20 inches long, the upper gradually shorter, all ascending or spreading, giving to the plant a bushy, wide-spreading habit. Leaves of medium size and medium to light green in color. Pods borne quite abundantly, 3 to 6 to the cluster, very small, nearly cylindrical, three-fourths inch to  $1\frac{1}{4}$  inches long, three-sixteenths to five-sixteenths inch wide, 2 or occasionally 3 seeded, remaining greenish yellow until nearly ripe, then becoming somewhat reddish. The seeds are all round or spherical, 4 to  $6\frac{1}{2}$  mm. in diameter, the normal color a light brown, resembling the seeds of some forms of the gram (*Phaseolus mungo*).

From one hundred and eight to one hundred and twenty-five or more days are required to bring this variety to maturity, the average being about one hundred and fifteen to one hundred and twenty days. The longer periods seem to be accompanied by a considerably taller growth, and it seems likely that with careful selection this variety can be developed into a very valuable hay plant. The few yields of seed recorded are all small, usually less than 5 bushels to the acre.

The name is derived from the color and small size of the seeds.

*Numbers and sources of lots grown.*—Agrost. No. 1542, S. P. I. No. 6414; S. P. I. No. 6414, from Ping-yang, Korea; S. P. I. No. 9417, grown from S. P. I. No. 6414; S. P. I. No. 17256, grown from Agrost. No. 1542-1.

#### MOTTLED-SEEDED GROUP.

##### HANKOW.

The description and notes already given for the Riceland apply equally well to the Hankow variety, except for the color of the seeds. Both were obtained in China at the same time and place and were noted as being grown in the same way for the same purpose. In all the tests made they have behaved exactly alike. The seeds are of medium size, rather narrowly elliptical, 4 to  $5\frac{1}{2}$  mm. wide by 6 to 8 mm. long, 5 to  $6\frac{1}{2}$  mm. being a common size. The ground color is light to medium brown and the mottling is black. The black is present usually as a more or less sharply defined patch or saddle of varying size and elliptical shape on either side of the "eye," or hilum. In addition, there are usually one or two narrow or broader eccentric lines or stripes of black outside the patch and parallel to its edge, thus forming a broken ellipse near the margin of the flattened seed. The two sides of a bean are frequently unlike in their markings.

S. P. I. No. 9344, from China, has very similar seeds, rather plumper, and much discolored, but with more dark color than in the variety just described. The black is usually massed as a saddle around the eye and extending outward over about half or more of the surface. This serial number has not been tested by the writer, and its characteristics are not known.

The name is derived from the city of Hankow.

*Numbers and sources of lots grown.*—Agrost. No. 972, S. P. I. 6559, from Chiu Niu (near Hankow), China.

#### MEYER.

S. P. I. No. 17852 is a recent importation from China, secured by Mr. F. N. Meyer. From the seed alone it is certain that this is a distinct variety of the mottled group. The seeds are plump and shiny, broadly elliptical,  $6\frac{1}{2}$  to 8 mm. broad, 7 to 10 mm. long, the ground color deep brown, with patches or blotches of black on either side near the hilum and eccentric curved lines or stripes of the same color near the dorsal edge. The amount of this black color is quite variable, some seeds being quite covered with it and some showing only faint lines of it.

### GREEN-SEEDED GROUP.

#### SAMAROW.

Samarow is a dwarf early variety of unknown origin. It has been sold for several years by J. M. Thorburn & Co., New York, under the name Green Samarow. It may readily be distinguished from all other varieties by the elongated, flattened, light-green seeds, quite different in shape from those of any varieties which are similar in color.

The stems of the Samarow variety are slender, one-eighth to one-fourth inch in thickness at the base, 10 to 24 inches tall, well branched with short branches, the lower ones only 4 to 5 inches long, ascending or spreading; leaves broad but not large, generally very dark green. The stem and branches are thickly set with medium-sized pods,  $1\frac{1}{4}$  to  $1\frac{3}{4}$  inches long by one-fourth to one-third inch wide, 2 to 4 seeded; often one-half of the pods on a plant will contain 3 seeds each, which is a higher proportion than has been observed in any other variety, while pods containing 4 seeds each are not uncommon. The seeds are elliptical, distinctly elongated, or some almost reniform (kidney-shaped), 5 to  $6\frac{1}{2}$  mm. wide by 7 to 9 mm. long, dull to faintly shining, very pale green or pea green in color. The variety may be easily recognized by the elongated, pale green seeds, the only other elongated seeds being black or mottled.

The Samarow soy bean requires from ninety to one hundred and five days to come to full maturity, the average being about ninety-five days. It is a fair to good yielder of seed and it is for this purpose that it is likely to be grown. The yields reported run from 5 to nearly 15 bushels per acre. The small size of the plants makes it unprofitable to grow for forage production, but the abundant crop of pods, containing 3 seeds commonly and 4 occasionally, suggests the possibility of breeding for high seed yields.

*Numbers and sources of lots grown.*—Agrost. No. 1302, "Green Samarow," J. M. Thorburn & Co.; Agrost. No. 1470, "Green Samarow," J. M. Thorburn & Co.; Agrost. No. 1972, "Green Samarow," union of Agrost. Nos. 1302 and 1470; S. P. I. No. 17260, grown from Agrost. No. 1972.

#### GUELPH.

The Guelph is one of the oldest and best known of the varieties in cultivation. For many years it has been sold by numerous seed houses as Early Green, Medium Green, and Medium Early Green. It is a rather curious fact that during the eight years in which the United States Department of Agriculture has been actively engaged in the introduction of oriental legumes it has but once secured this variety. This is prob-



ably due to the fact stated by writers on Japanese agriculture that the green-seeded and the brown-seeded forms are but sparingly cultivated in the Orient, the blacks and yellows being much preferred.

The Guelph soy bean has become quite a favorite in the Northern States of this country, where it is highly esteemed for both seed and forage production. In Kansas, Indiana, Michigan, and in Ontario it has given splendid results in comparative tests extending through several years.

The Guelph variety grows from 24 to 38 inches high, stems medium stout, one-fourth to three-eighths inch in diameter, well branched with ascending or spreading branches, 6 inches long at the bottom, often completely filling the space between rows 3 to 3½ feet apart. The leaves are very dark green, large and full in the center, with the margin often much wrinkled or crinkly, due to vigorous but uneven growth of the different parts of the leaf. The pods are medium in size, 1 to 1½ inches long by three-eighths inch wide, 2 to 3 seeded, borne thickly on the main stem and branches and usually far enough above the ground to permit easy harvesting. The seeds are nearly round in outline, 6 to 8 mm. in diameter, distinctly flattened, 4 to 5 mm. thick in dorso-ventral view. In color they are bright green and quite shiny.

The Guelph variety is medium in time of ripening, varying from one hundred and five to one hundred and twenty days, one hundred and eight to one hundred and fourteen days being the average time. Six lots of this variety tested at the Kansas Experiment Station in 1903 all ripened in one hundred and seven days, yielding from 3¾ to 10½ bushels of seed to the acre and averaging 6½ bushels. Eight lots tested at Washington the same year matured in one hundred and five to one hundred and fifteen days, yielding from 5¾ to 14½ bushels to the acre, the average being 8¾ bushels. Yields of from 16 to 18 bushels were secured in Indiana. At the Ontario Experiment Farm the average annual yield of green fodder for a period of four years was 11 tons to the acre. Virginia and Delaware report yields of 7 to 10 tons of green forage to the acre. This variety shatters rather badly if allowed to become fully ripe, which is an objection to its use as a seed crop. Its large size and freely branching habit make it a most excellent variety for pasture, hay, silage, and cover crop, and for these purposes it should be widely grown.

At the Ontario Agricultural College and Experiment Farm, located at Guelph, Ontario, a great deal of work has been done with soy beans, and with this variety especially, and the name is given for that reason.

*Numbers and sources of lots grown.*—Agrost. No. 912, "Early Green," J. M. Thorburn & Co.; Agrost. No. 969, S. P. I. No. 6558; Agrost. No. 1306, "Medium Early Green," J. M. Thorburn & Co.; Agrost. No. 1312, "Medium Green," Henderson & Co.; Agrost. No. 1464, "Early Green," Henderson & Co.; Agrost. No. 1467, "Medium Early Green," J. M. Thorburn & Co.; Agrost. No. 1469, "Medium Early Green," Breck & Sons; Agrost. No. 1473, "Medium Early Green," Hammond Seed Co.; Agrost. No. 1476, "Medium Early Green," Currie Bros.; Agrost. No. 1764, "Early Green," Kans. Expt. Station; Agrost. No. 1971, "Medium Green," union of Agrost. Nos. 912, 969, 1306, 1312, 1464, 1467, 1469, 1473, and 1476; S. P. I. No. 6558, Hankow, China; S. P. I. No. 13503, Agrost. No. 912; S. P. I. No. 17261, grown from Agrost. Nos. 1764 and 1971.

## GREENISH-YELLOW-SEEDED GROUP.

### YOSHO.

The Yosho is a rather small, early form, with small stems, one-fourth inch in thickness, 12 to 30 inches high, with a few rather short branches, 2 to 4 inches long, rather stocky and bushy in appearance. Leaves large, medium green in color; pods only fairly abundant, medium sized, 1¼ to 1½ inches long by three-eighths inch or more wide, 2 or occasionally 3 seeded. The seeds are medium to large in size, 6½ to 7½ mm. wide,

7 to 8 mm. long, nearly round or broadly elliptical, somewhat flattened, greenish yellow and shining when fresh, becoming paler and duller with age, the hilum marked with pale brown.

Yosho is a very early variety, maturing in eighty-five to one hundred days, averaging ninety-two to ninety-seven days. It gives only a fair yield of seeds and a low yield of vines. Seed yields of  $4\frac{3}{8}$  to  $6\frac{3}{8}$  bushels per acre are recorded.

The name is formed by shortening the Japanese word Yoshioka.

*Numbers and sources of lots grown.*—Agrost. No. 1297, S. P. I. No. 6314; S. P. I. No. 6314, "Yoshioka," Japan; S. P. I. No. 8489, grown from S. P. I. No. 6314; S. P. I. No. 17262, grown from Agrost. No. 1297-2.

#### HABERLANDT.

The stems are medium size, one-fourth to three-eighths inch in diameter at the base, 20 to 40 inches in height, the average being 24 to 30 inches, well provided with numerous long, ascending to rather wide-spreading branches, the lower ones from 6 to 12 inches or more in length; the leaves medium to broad, narrowed toward the tip, medium to light green in color. A plot grown in 1905 at Baton Rouge, La., had foliage of a very light glaucous green, much resembling a plot of rape in color. The same appearance was also reported for this variety by the Virginia Agricultural Experiment Station. The stem and long branches are well set with pods  $1\frac{1}{4}$  to  $1\frac{3}{4}$  inches long and three-eighths to one-half inch wide. The seeds are medium or large, the present generation (1905) nearly round,  $6\frac{1}{2}$  to 8 mm. wide by 7 to 8 mm. long, clear greenish yellow, shining, decidedly paler when two or three years old, the third generation back from the present larger and longer, 7 to 8 mm. wide by 7 to  $9\frac{1}{2}$  mm. long, all somewhat flattened; hilum deep brown.

The time required for this variety to reach maturity varies from one hundred and ten to one hundred and thirty days, the average time being somewhere near one hundred and eighteen to one hundred and twenty days. Two seed yields secured were  $12\frac{9}{10}$  and  $13\frac{3}{10}$  bushels to the acre, respectively. The Haberlandt is one of the most promising varieties for hay, silage or green manuring, and for a cover crop. From the Tokyo it can be distinguished only by its earlier maturity, rather deeper greenish yellow seed and distinctly brown hilum.

This variety was named in honor of Prof. A. Haberlandt, who first brought the soy bean to agricultural notice in Europe. His work was published in 1878 at Vienna.

*Numbers and sources of lots grown.*—Agrost. No. 1194, "White," S. P. I. No. 6396; Agrost. No. 1539, S. P. I. No. 8495; Agrost. No. 1540, S. P. I. No. 8493; S. P. I. No. 6396, "White," Ping-yang, Korea; S. P. I. No. 6397, Ping-yang, Korea; S. P. I. No. 8493, grown from S. P. I. No. 6396; S. P. I. No. 8495, grown from S. P. I. No. 6397; S. P. I. No. 9415, grown from S. P. I. No. 8493; S. P. I. No. 9416, grown from S. P. I. No. 6397; S. P. I. No. 17263, grown from Agrost. No. 1539-1; S. P. I. No. 17271, grown from Agrost. No. 1,94-1.

#### TOKYO.

The Tokyo differs from the medium greenish yellow (Haberlandt) variety mostly in a somewhat more vigorous growth and in later ripening. It is a very large and vigorous, long-branched variety; stems one-fourth to one-half inch in thickness, 28 to 42 inches in height. In this it scarcely excels the best records for the Haberlandt, but in the average height reached, about 36 inches, it considerably overtops that variety. The branches are 5 to 10 in number, the lower ones 10 to 15 inches long, ascending or spreading, the plant bushy enough to completely close the spaces between  $3\frac{1}{2}$ -foot rows, inclined to be top-heavy and to lodge somewhat where grown thinly. The leaves are large, 3 to 4 inches long, 2 to  $2\frac{1}{2}$  inches wide, medium to very dark green in



color. The pods are large,  $1\frac{1}{2}$  to 2 inches in length, about one-half inch in width, 2 to 3 seeded. Seeds large, 7 to 9 mm. wide by 7 to 10 mm. long, round or broadly elliptical, somewhat flattened or occasionally spherical, greenish yellow, shiny, paler and duller with age. The seed of later generations is noticeably smaller than that of the earlier ones, probably due to too thick planting of so large a variety and to forcing maturity in a shorter growing season.

The Tokyo is one of the very best varieties for all-round use. It will give heavy hay and silage crops, is equally good for pasture and cover-crop purposes, and where it matures it gives very good seed yields. Eight plots grown at Washington in two different years averaged  $8\frac{1}{2}$  bushels of seed per acre, in which the lowest yield was 4 bushels and the highest  $14\frac{1}{2}$  bushels. The Kentucky Agricultural Experiment Station reports a very much higher seed yield, with the weight of green for ge to the acre 11.84 and 14.08 tons from two plots, curing to 5.44 and 6.16 tons, respectively. It is too late for the best results in most Northern States, but it may be replaced there by the Haberlandt variety.

This variety was named for the Japanese capital, where some of the importations were secured.

*Numbers and sources of lots grown.*—Agrost. No. 468, grown from S. P. I. No. 4914; Agrost. No. 696, grown on Potomac Flats; Agrost. No. 1171, "Best Green," S. P. I. No. 9409; Agrost. No. 1198, "Late Ita Name," S. P. I. No. 8424, Japan; Agrost. No. 1200, "Medium Ita Name," S. P. I. No. 8423, Japan; Agrost. No. 1298, "Medium Green," S. P. I. No. 6335, Japan; S. P. I. No. 4914, "Best Green," Japan; S. P. I. No. 5766, grown from No. 4914; S. P. I., No. 6335, "Medium Green," Japan; S. P. I., No. 8423, "Medium Ita Name," Japan; S. P. I. No. 8424, "Late Ita Name," Japan; S. P. I. No. 9409, grown from S. P. I. No. 5766; S. P. I. No. 17264, grown from Agrost. No. 1198-1; S. P. I. No. 17265, grown from Agrost. No. 1200-1; S. P. I. No. 17266, grown from Agrost. No. 1171-1; S. P. I. No. 17267, grown from Agrost. No. 1298-2.

## YELLOW-SEEDED GROUP.

### ITO SAN.

Ito San is probably the best known variety of soy bean on the market. The original source of the variety is not known, but it was very probably one of the early importations made by the Kansas and Massachusetts agricultural experiment stations; perhaps by others also. It has been long and widely sold under the names "Yellow," "Early Yellow," "Early White," etc. It is said that the name "Ito San" was given it by Mr. E. E. Evans, of West Branch, Mich. The greatest value of the Ito San lies in its earliness and fairly large yield of seeds. It is too small to yield heavily for hay, silage, etc. It remains, however, one of the most popular varieties on the northern market.

The Ito San is a rather small, early variety, with slender stems about one-fourth inch in thickness at the base, 12 to 28 inches high, the average being 18 to 24 inches; the branches are long and numerous, ascending or erect, nearly or quite equaling the main stem in height; leaves small to medium, narrow, light green to almost a bluish or glaucous green; pods scattered along the whole length of the main stem and the branches, slender,  $1\frac{1}{4}$  to  $1\frac{3}{4}$  inches long, three-eighths inch wide, 2 or often 3 seeded. The seeds are small, 5 to  $6\frac{1}{2}$  mm. wide,  $5\frac{1}{2}$  to 7 mm. long, round or slightly elliptical, a pale lemon-yellow, scarcely shiny when fresh, becoming paler and duller with age, hilum occasionally brownish, but normally yellow.

Ito San commonly matures in from ninety to one hundred days, with the average between ninety and ninety-five days. Occasionally it ripens in less than ninety days, and in cold, wet seasons it will require more than one hundred days. It is

rather too small for best results as a hay and silage crop, except where quick returns are desired. The Kentucky Agricultural Experiment Station reports  $5\frac{3}{10}$  tons of green fodder per acre, curing to  $1\frac{1}{2}$  tons. In Ontario, Canada, the average height for four years was 27 inches and average yield of green hay  $8\frac{1}{2}$  tons. In 1903 the Kansas Agricultural Experiment Station secured yields of  $14\frac{1}{2}$  to  $15\frac{7}{10}$  bushels of seed from four different plats. All showed a high percentage of nondehiscence of the pods—88 to 96 per cent. At the Massachusetts Agricultural Experiment Station the seed yields have varied between 18 and 20 bushels in favorable years.

*Numbers and sources of lots grown.*—Agrost. No. 658, "Kaiyuski Daizu;" Agrost. No. 1183, "Adzuki," R. I. Agric. Expt. Station; Agrost. No. 1186, "Yellow;" Agrost. No. 1187, "Early White," R. I. Agric. Expt. Station; Agrost. No. 1189, "Yellow Eda Mame," R. I. Agric. Expt. Station; Agrost. No. 1192, "Kiyusuke Daidzu," R. I. Agric. Expt. Station; Agrost. No. 1294, "Rokugatsu," S. P. I. No. 6326; Agrost. No. 1313, "Ito San," J. M. Thorburn & Co.; Agrost. No. 1316, "Early," F. Barteldes & Co.; Agrost. No. 1468, "Ito San," J. M. Thorburn & Co.; Agrost. No. 1475, "Ito San," Hammond Seed Co.; Agrost. No. 1478, "Early Yellow," Currie Bros.; Agrost. No. 1765, "Early Yellow," Kansas Agric. Expt. Station; Agrost. No. 1973, union of Agrost. Nos. 1183, 1186, 1187, 1294; Agrost. No. 1974, union of Agrost. Nos. 1189, 1192, 1316, 1478, 1540; Agrost. No. 1975, union of Agrost. Nos. 1316, 1468, 1475; S. P. I. No. 6326, "Rokugatsu," Japan; S. P. I. No. 17268, grown from Agrost. Nos. 1765, 1973, 1974, 1975.

#### MANHATTAN.

The Manhattan is a dwarf early variety with medium stems 15 to 24 inches high, averaging about 20 inches, stocky, branches short and ascending; leaves medium to large, dark green in color; pods numerous,  $1\frac{1}{2}$  to 2 inches long, three-eighths to seven-sixteenths inch wide, 2 to commonly 3 seeded; seeds medium in size, round, broadly elliptical in outline, 7 to 8 mm. wide, 7 to 9 mm. long, considerably flattened, rather pale yellow with a slight greenish tinge, becoming paler with age, hilum brown.

The Manhattan variety is early to medium early, requiring from ninety to one hundred and ten days to reach maturity, the average being about one hundred to one hundred and five days. It is too small to have much forage value, and its chief use will be for an early seed crop, to which purpose it is fairly well adapted. Several yields of from 14 to 16 bushels to the acre are recorded.

This variety was named for the location of the Kansas Agricultural Experiment Station, Manhattan, Kans., where the soy bean has been under extensive experimentation for many years.

*Numbers and sources of lots grown.*—Agrost. No. 1295, S. P. I. No. 6333; S. P. I. No. 6333, "Gosha," Japan; S. P. I. No. 8490, grown from S. P. I. No. 6333; S. P. I. No. 9411, grown from S. P. I. No. 6333; S. P. I. No. 17277, grown from Agrost. No. 1295-2.

#### BUTTERBALL.

An early or medium early variety, with short, stocky, unbranched stems, dark foliage, and large yellow seeds. Plants low, 15 to 25 inches high, stems small to medium, one-eighth to one-fourth inch in size at the base, with 2 to 5 short, stubby branches near the base; leaves large, usually dark green. Pods broad,  $1\frac{1}{2}$  to 2 inches long, one-half inch wide, 2 or rarely 3 seeded. The seeds are large, 7 to  $8\frac{1}{2}$  mm. wide, 7 to 9 mm. long, spherical, pale lemon-yellow, somewhat shiny, becoming much paler and duller with age, the hilum pale or slightly brownish.

This variety is too small to have much value except for earliness and large size of the seed. The last quality may entitle it to attention in breeding experiments. It matures in ninety-five to one hundred and ten days. Yields of  $8\frac{1}{2}$  and  $14\frac{1}{2}$  bushels of seed to the acre are recorded.

The name, Butterball, was given to this variety on account of its round yellow seeds.

*Numbers and sources of lots grown.*—Agrost. No. 1197, "Early Japan," R. I. Agric. Expt. Station; Agrost. No. 1199, "Early Ita Name," S. P. I. No. 8422; S. P. I. No. 8422, "Early Ita Name," Japan; S. P. I. No. 17273, grown from Agrost. No. 1197-1; S. P. I. No. 17274, grown from Agrost. No. 1199-1.

#### AMHERST.

A rather low and stocky, well-branched variety, with large leaves and broad pods. Stems medium to stout, one-fourth to seven-sixteenths inch in thickness, 12 to 24 or 30 inches high; branches not numerous, ascending or appressed, the lower nearly as long as the stem and arising from very near its base; leaves very broad and large, medium green in color; pods very large,  $1\frac{1}{2}$  to  $2\frac{1}{4}$  inches long, one-half inch broad, 2 or 3 seeded, borne on stem and branches almost to the ground. The seeds are large, spherical, 7 to 9 mm. in diameter, often scarcely flattened in dorsal view, deep yellow with a slight greenish tinge, becoming paler and duller with age; hilum yellow or brownish.

The time required for the Amherst variety to reach maturity varies from one hundred and five to one hundred and thirty days, the average being about one hundred and fifteen to one hundred and twenty days. It ripens a few days later than the Guelph variety, which it somewhat resembles except in being considerably smaller. It has been grown successfully in the Northern States and is reported as a fair to good yielder. Tests at Washington, D. C., have given from 5 to more than 20 bushels to the acre; the Kansas Agricultural Experiment Station reports 10 bushels, while the Kentucky station quotes yields of from 26 to 40 bushels to the acre.

It will be noted that the greenish tinge on the seeds indicates the relationship of this with the three greenish yellow varieties. Inspection of the tables will show that it lies between Yoshio and Haberlandt in size and maturity, and rather nearer to the latter in both. In habit it is also very near Haberlandt.

This variety was named for the Massachusetts Agricultural Experiment Station, at Amherst, Mass., where soy beans have been cultivated for many years from specially imported seed.

*Numbers and sources of lots grown.*—Agrost. No. 452, grown from S. P. I. No. 4913; Agrost. No. 1170, S. P. I. No. 9408; Agrost. No. 1296, S. P. I. No. 6336; S. P. I. No. 4913, "Best White;" S. P. I. No. 5765, grown from S. P. I. No. 4913; S. P. I. No. 6336, "Bakaziro," Japan; S. P. I. No. 8494, grown from S. P. I. No. 6336; S. P. I. No. 9408, grown from S. P. I. No. 5765; S. P. I. No. 9413, grown from S. P. I. No. 6336; S. P. I. No. 12400, grown from S. P. I. No. 9408; S. P. I. No. 17275, grown from Agrost. Nos. 1170-2 and 1296-2.

#### HOLLYBROOK.

A fairly large, medium late variety, with long appressed or ascending branches. Stems fairly stout, one-fourth to three-eighths or one-half inch in diameter at the base, 20 to 36 inches tall, 25 to 30 inches representing the average height; branches nearly as long as the main stem, appressed or ascending; leaves large, medium green in color, pods quite thickly set on stem and branches, medium in size, 1 to  $1\frac{1}{2}$  inches long, three-eighths inch wide, mostly 2 seeded. Seeds medium in size, 6 to 7 mm. wide, 6 to 8 mm. long, some spherical, mostly broadly elliptical, somewhat flattened in dorso-ventral view, deep or lemon yellow, very shiny, becoming paler and duller with age; hilum usually pale brown.

For the most part this variety has been too late to mature in the Northern States, though it has been called early in Massachusetts and Rhode Island in a favorable season. It requires from one hundred and ten to one hundred and thirty-five days to reach maturity, the average being about one hundred and twenty days. Yields



of 5, 9, and 20 bushels to the acre have been secured at Washington, and still better yields at some other points. This variety should make a good hay and silage crop where sown somewhat thickly. When thinly sown it has a tendency to become top-heavy and to lodge somewhat.

The Hollybrook variety was originated by Messrs. T. W. Wood & Sons, of Richmond, Va., as an early selection from Mammoth Yellow. The name "Hollybrook" was given it by them, and is the name of the seed farm on which the variety originated.

*Numbers and sources of lots grown.*—Agrost. No. 454, grown from S. P. I. No. 4912; Agrost. No. 976, S. P. I. No. 6556; Agrost. No. 1169, S. P. I. No. 9407; Agrost. No. 1196, S. P. I. No. 3870; Agrost. No. 1299, from Havre, France; Agrost. No. 1538, S. P. I. No. 6379; Agrost. No. 2032, "Hollybrook," Arkansas Agric. Exp. Station; S. P. I. No. 3870, China; S. P. I. No. 4912, "Common soy," Japan; S. P. I. No. 5764, grown from S. P. I. No. 4912; S. P. I. No. 6379, grown from S. P. I. No. 3870; S. P. I. No. 6556, "The most common soy," China; S. P. I. No. 9407, grown from S. P. I. No. 4912; S. P. I. No. 12399, grown from S. P. I. No. 9407; S. P. I. No. 17269, grown from Agrost. No. 976-2; S. P. I. No. 17270, grown from Agrost. No. 1169-2; S. P. I. No. 17272, grown from Agrost. No. 1538-1; S. P. I. No. 17276, grown from Agrost. No. 1299-1 and 1299-2; S. P. I. No. 17278, grown from Agrost. No. 2032.

#### MAMMOTH.

The Mammoth is the best known and most widely cultivated variety in the Southern States. It has also been sold to a considerable extent in the North, mostly because of the splendid growth it makes, but it has never given satisfaction there because of its lateness. It has been a commercial variety in this country for a great many years, but its origin is not known. None of the varieties yet imported by this Department has proved to be exactly the same form. The Hollybrook is the most closely related, but differs in its considerably lower growth and in being a little earlier also. The Mammoth is the largest variety here discussed, though not quite so tall as the Riceland and Hankow.

The main stems are from one-fourth to more than one-half inch in diameter at the base, from 24 or 30 to fully 48 inches in height, well branched from quite near the base, with long, ascending branches, the lower ones from 1½ to 2 feet long, the leaves very large, usually rather more pointed than in the other large-leaved varieties, medium to dark in color; pods 1 to 1½ inches long, three-eighths to seven-sixteenths inch wide, 2 or often 3 seeded, scattered over the stem and long branches; the seeds are medium in size, 6 to 6½ mm. wide, 6 to 7½ or 8 mm. long, spherical or broadly oblong in outline, somewhat flattened, bright lemon-yellow, shining, becoming paler and duller with age; hilum usually pale brown.

The time required to reach maturity varies from one hundred and ten to one hundred and forty days, the average being one hundred and twenty and one hundred and thirty days. The yields of 17 plats at Washington varied between 4½ and 15 bushels to the acre, with an average of 9½ bushels.

The name, Mammoth, is very suitable for this variety, and is coming into use for it in the agricultural press and by some seedsmen.

*Numbers and sources of lots grown.*—Agrost. No. 1195, "Yellow," S. P. I. No. 4285, Virginia; Agrost. No. 1300, "Late," F. Barteldes & Co.; Agrost. No. 1305, T. W. Wood & Sons; Agrost. No. 1307, "Southern," T. W. Wood & Sons; Agrost. No. 1308, Iowa Seed Co.; Agrost. No. 1309, Johnson & Stokes; Agrost. No. 1310, Plant Seed Co.; Agrost. No. 1311, C. J. McCullough; Agrost. No. 1314, "Late Yellow," Peter Henderson & Co.; Agrost. No. 1315, Northrup, King & Co.; Agrost. No. 1465, "Yellow," Breck & Sons; Agrost. No. 1466, "Yellow," Texas Seed and Floral Co.; Agrost. No. 1472, "Southern," J. M. Thorburn & Co.; Agrost. No. 1477, Hammond Seed Co.; Agrost.

No. 1976, union of seven of above serial numbers; Agrost. No. 1977, union of seven of above serial numbers; S. P. I. No. 4285, "Yellow," T. W. Wood & Sons; S. P. I. No. 17280, grown from Agrost. Nos. 1976 and 1977.

### LIST OF SYNONYMS.

The following is a list of the names under which soy beans have been received from experiment stations, seedsmen, and growers in the United States. It includes all the important names under which varieties have been sold or written about in the agricultural press, seed catalogues, and experiment station bulletins. After each such name is given the name under which the variety is described in this bulletin.

Adzuki.....	Ito San.	Kaiyuski Daizu.....	Ito San.
Black.....	Buckshot.	Kiyusuki Daidzu.....	Ito San.
Brown Eda Mame.....	Eda.	Kysuki.....	Ito San.
Crossbred No. 6.....	Ogemaw.	Large Black.....	Buckshot.
Early Black.....	Buckshot.	Late Yellow.....	Mammoth.
Early Green.....	Guelph.	Mammoth Yellow.....	Mammoth.
Early Japan.....	Butterball.	Medium Black.....	Buckshot.
Early White.....	Ito San.	Medium Early Black.....	Buckshot.
Early Yellow.....	Ito San.	Medium Early Green.....	Guelph.
Extra Early Black.....	Buckshot.	Medium Green.....	Guelph.
Green.....	Guelph.	Ogema.....	Ogemaw.
Green Samarow.....	Samarow.	Southern.....	Mammoth.
Hollybrook.....	Hollybrook.	Yellow.....	Mammoth.
Ito San.....	Ito San.	Yellow Eda Mame.....	Ito San.
Japanese No. 15.....	Kingston.		

### DISTRIBUTION NUMBERS.

The following are the serial numbers under which soy beans were distributed by the former Division of Agrostology, with the name of the variety to which each has been referred:

452. Amherst.	1188. Kingston.	1299. Hollybrook.
454. Hollybrook.	1189. Ito San.	1300. Mammoth.
468. Tokyo.	1192. Ito San.	1301. Buckshot.
658. Ito San.	1193. Ebony.	1302. Samarow.
696. Tokyo.	1194. Haberlandt.	1303. Buckshot.
912. Guelph.	1195. Mammoth.	1304. Buckshot.
964. Riceland.	1196. Hollybrook.	1305. Mammoth.
969. Guelph.	1197. Butterball.	1306. Guelph.
972. Hankow.	1198. Tokyo.	1307. Mammoth.
976. Hollybrook.	1199. Butterball.	1308. Mammoth.
1169. Hollybrook.	1200. Tokyo.	1309. Mammoth.
1170. Amherst.	1292. Buckshot.	1310. Mammoth.
1171. Tokyo.	1293. Flat King.	1311. Mammoth.
1183. Ito San.	1294. Ito San.	1312. Guelph.
1184. Buckshot	1295. Manhattan.	1313. Ito San.
1185. Eda.	1296. Amherst.	1314. Mammoth.
1186. Ito San.	1297. Yoshō.	1315. Mammoth.
1187. Ito San.	1298. Tokyo.	1316. Ito San.

1464. Guelph.	1477. Mammoth.	1973. Ito San.
1465. Mammoth.	1478. Ito San.	1974. Ito San.
1466. Mammoth.	1536. Nuttall.	1975. Ito San.
1467. Guelph.	1538. Hollybrook.	1976. Mammoth.
1468. Ito San.	1539. Haberlandt.	1977. Mammoth.
1469. Guelph.	1540. Haberlandt.	1978. Buckshot.
1470. Samarow.	1541. Ebony.	1979. Buckshot.
1471. Buckshot.	1542. Brownie and Baird.	1980. Ebony.
1472. Mammoth.	1764. Guelph.	1992. Ogemaw.
1473. Guelph.	1765. Ito San.	2031. Ogemaw.
1474. Buckshot.	1971. Guelph.	2032. Hollybrook.
1475. Ito San.	1972. Samarow.	2033. Buckshot.
1476. Guelph.		

The following is a list of the serial numbers under which soy beans have been distributed by the Office of Seed and Plant Introduction and Distribution, with the name of the variety to which each is referred in this bulletin. Several S. P. I. numbers representing soy beans not studied by the writer are not included in the list.

3870. Hollybrook.	8490. Manhattan.	17253. Nuttall.
4285. Mammoth.	8491. Buckshot.	17254. Ebony.
4912. Hollybrook.	8492. Ebony.	17255. Kingston.
4913. Amherst.	8493. Haberlandt.	17256. Brownie and Baird.
4914. Tokyo.	8494. Amherst.	17257. Eda.
5764. Hollybrook.	8495. Haberlandt.	17258. Ogemaw.
5765. Amherst.	8496. Nuttall.	17259. Ogemaw.
5766. Tokyo.	8497. Flat King.	17260. Samarow.
6312. Flat King.	9344. (Probably Hankow.)	17261. Guelph.
6314. Yoshio.	9407. Hollybrook.	17262. Yoshio.
6326. Ito San.	9408. Amherst.	17263. Haberlandt.
6333. Manhattan.	9409. Tokyo.	17264. Tokyo.
6334. Buckshot.	9410. Flat King.	17265. Tokyo.
6335. Tokyo.	9411. Manhattan.	17266. Tokyo.
6336. Amherst.	9412. Buckshot.	17267. Tokyo.
6379. Hollybrook.	9413. Amherst.	17268. Ito San.
6386. Ebony.	9414. Ebony.	17269. Hollybrook.
6396. Haberlandt.	9415. Haberlandt.	17270. Hollybrook.
6397. Haberlandt.	9416. Haberlandt.	17271. Haberlandt.
6414. Brownie and Baird.	9417. Brownie and Baird.	17272. Hollybrook.
6416. Nuttall.	9418. Nuttall.	17273. Butterball.
6556. Hollybrook.	11179. Buckshot.	17274. Butterball.
6558. Guelph.	12399. Hollybrook.	17275. Amherst.
6559. Hankow.	12400. Amherst.	17276. Hollybrook.
6560. Riceland.	13502. Ogemaw.	17277. Manhattan.
8422. Butterball.	13503. Guelph.	17278. Hollybrook.
8423. Tokyo.	16790. (Probably Riceland.)	17280. Mammoth.
8424. Tokyo.	17251. Buckshot.	17852. Meyer.
8489. Yoshio.	17252. Flat King.	

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# PLATES.

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## DESCRIPTION OF PLATES.

PLATE I. *Frontispiece*. Seeds of all varieties of soy beans in natural sizes and colors.

Black-seeded group: 1.—Buckshot. 2.—Nuttall. 3.—Kingston. 4.—Ebony. 5.—Flat King. 6.—Riceland; one seed washed, one with bloom. 6*a*.—A larger undetermined soy bean from Italy. Brown-seeded group: 7.—Ogemaw. 8.—Eda, showing different shades of color. 9.—Baird and Brownie (the two left-hand seeds, Baird; the right-hand seed, Brownie). Mottled-seeded group: 10.—Meyer. 11.—Hankow; one seed washed, one with bloom, one in dorsal view. Green-seeded group: 12.—Samarow. 13.—Guelph. 14.—Yosho; one lateral view, one ventral view showing hilum. 15.—Haberlandt; one lateral view, one ventral view showing hilum. 16.—Tokyo; one lateral view, one ventral view showing hilum. Yellow-seeded group: 17.—Ito San. 18.—Manhattan. 19.—Butterball. 20.—Amherst. 21.—Hollybrook. 22.—Mammoth.

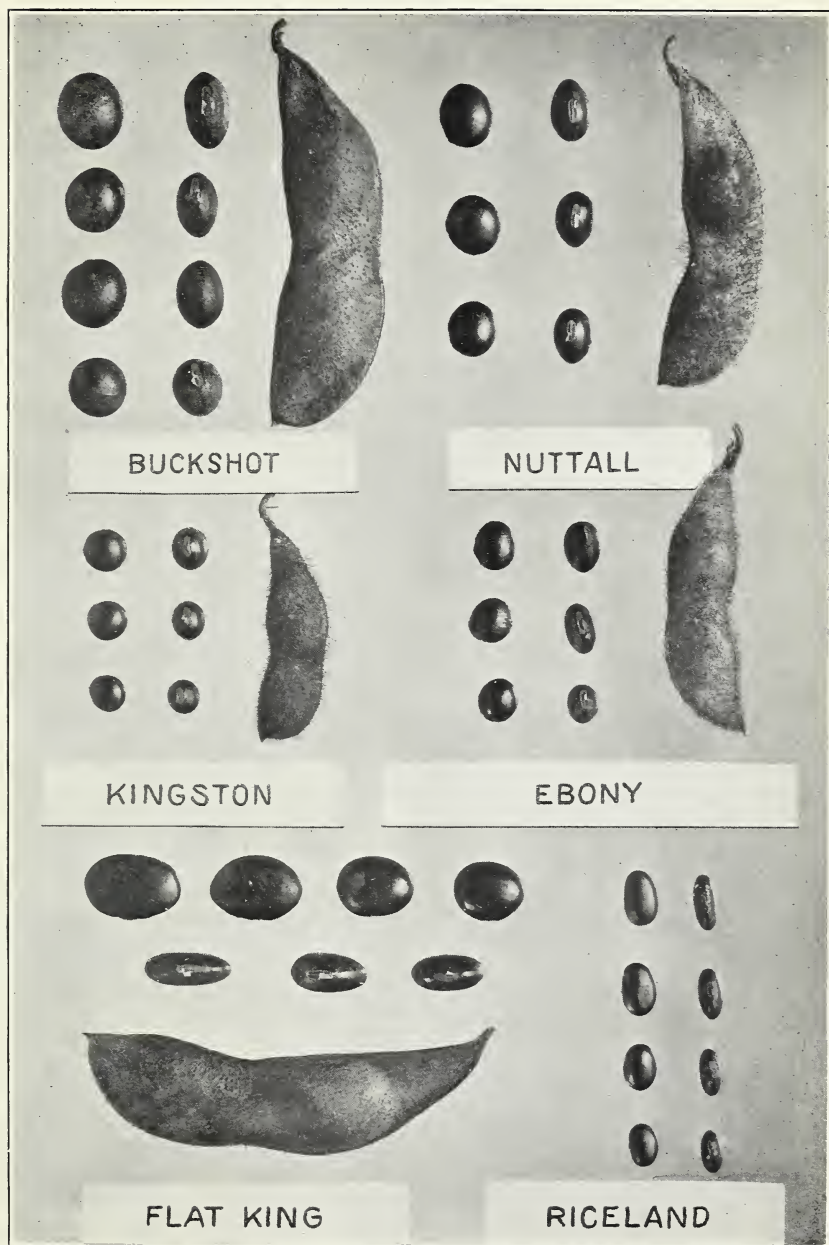
PLATE II. Seeds and pods of the black-seeded group. Seeds of different sizes in lateral and ventral (or hilum) view, and pods in lateral view: Buckshot, Nuttall, Kingston, Ebony, Flat King, Riceland, and a larger undetermined soy bean from Italy.

PLATE III. Seeds and pods of the brown-seeded and mottled-seeded groups. Seeds of different sizes in lateral and ventral (or hilum) view, and pods in lateral view: Ogemaw, Eda, Baird and Brownie (the four right-hand seeds and the upper pod, Brownie; the four left-hand seeds and the lower pod, Baird), Meyer, Hankow.

PLATE IV. Seeds and pods of the green-seeded and greenish-yellow-seeded groups. Seeds of different sizes in lateral and ventral (or hilum) view, and pods in lateral view: Samarow, Guelph, Yosho, Haberlandt, Tokyo.

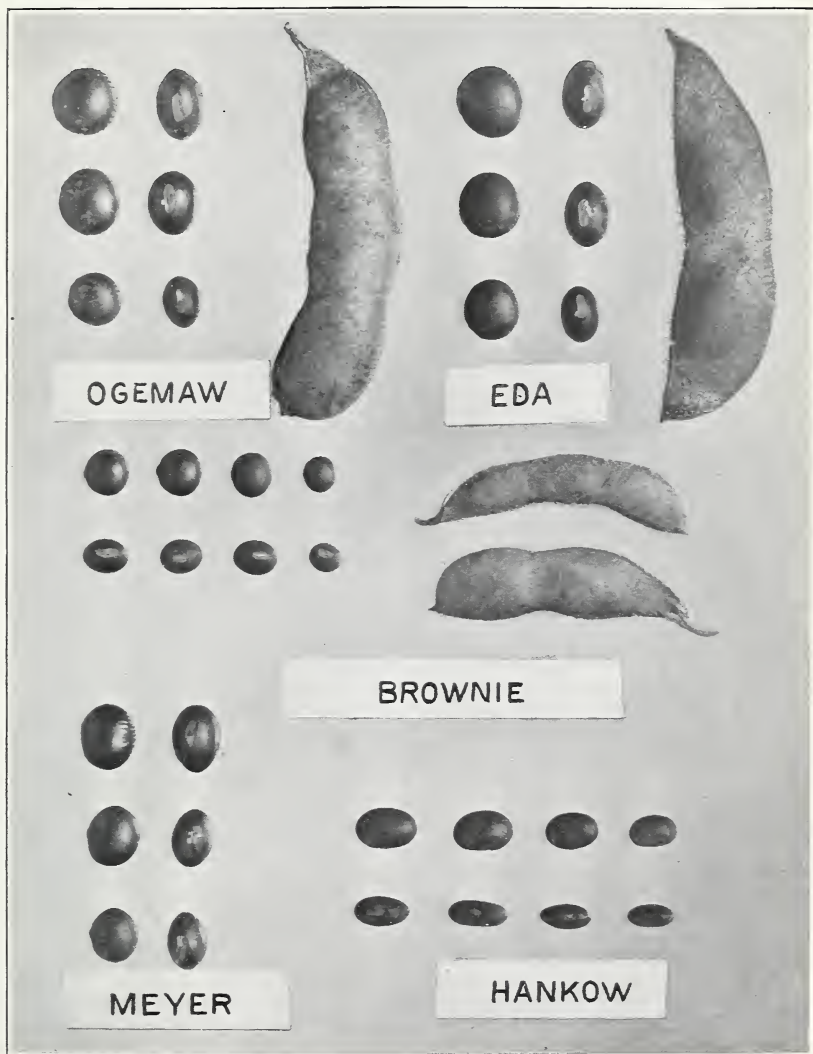
PLATE V. Seeds and pods of the yellow-seeded group. Seeds of different sizes in lateral and ventral (or hilum) view, and pods in lateral view: Ito San, Manhattan, Butterball, Amherst, Hollybrook, Mammoth.



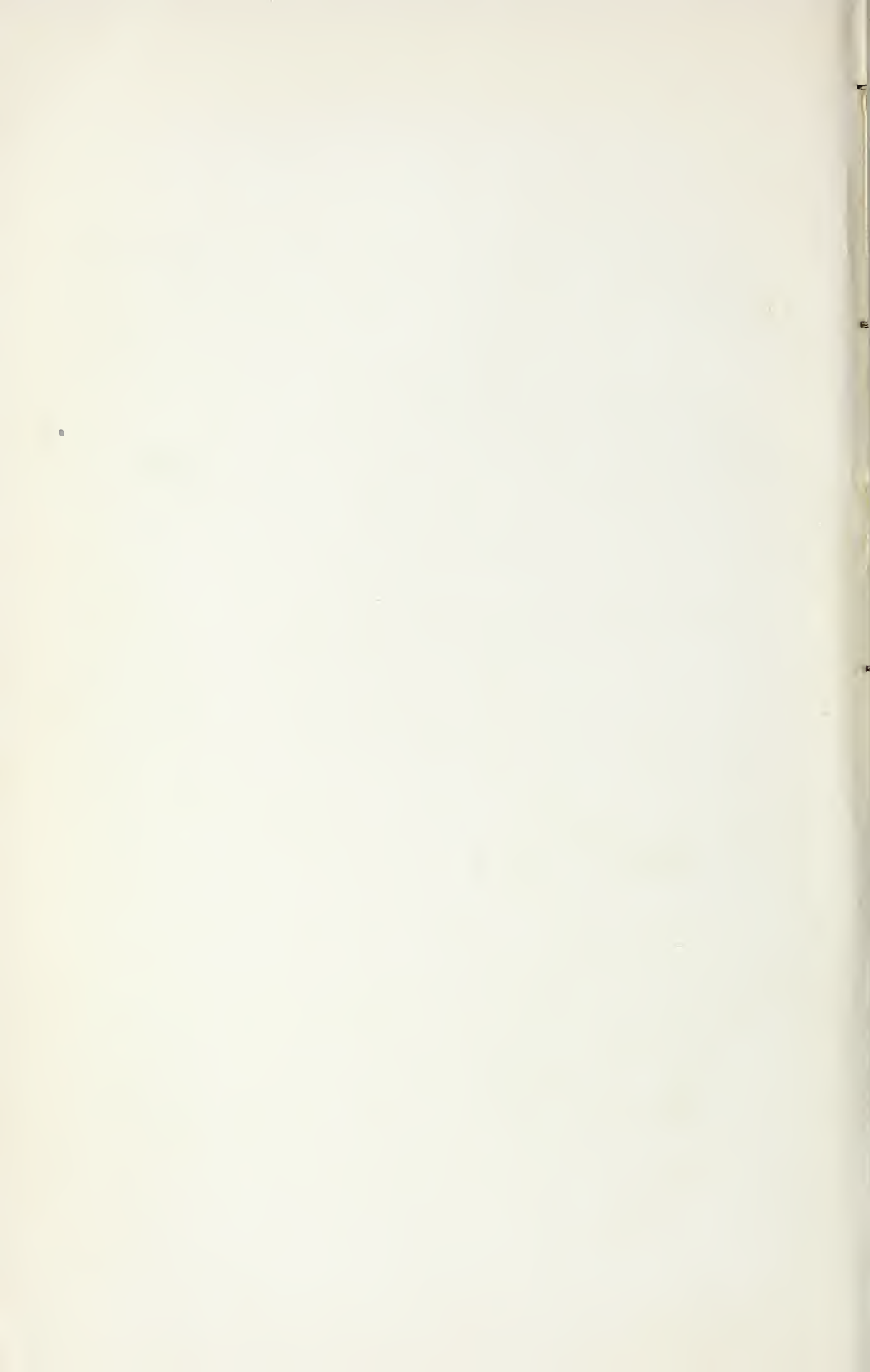


SEEDS AND PODS OF THE BLACK-SEEDING GROUP.

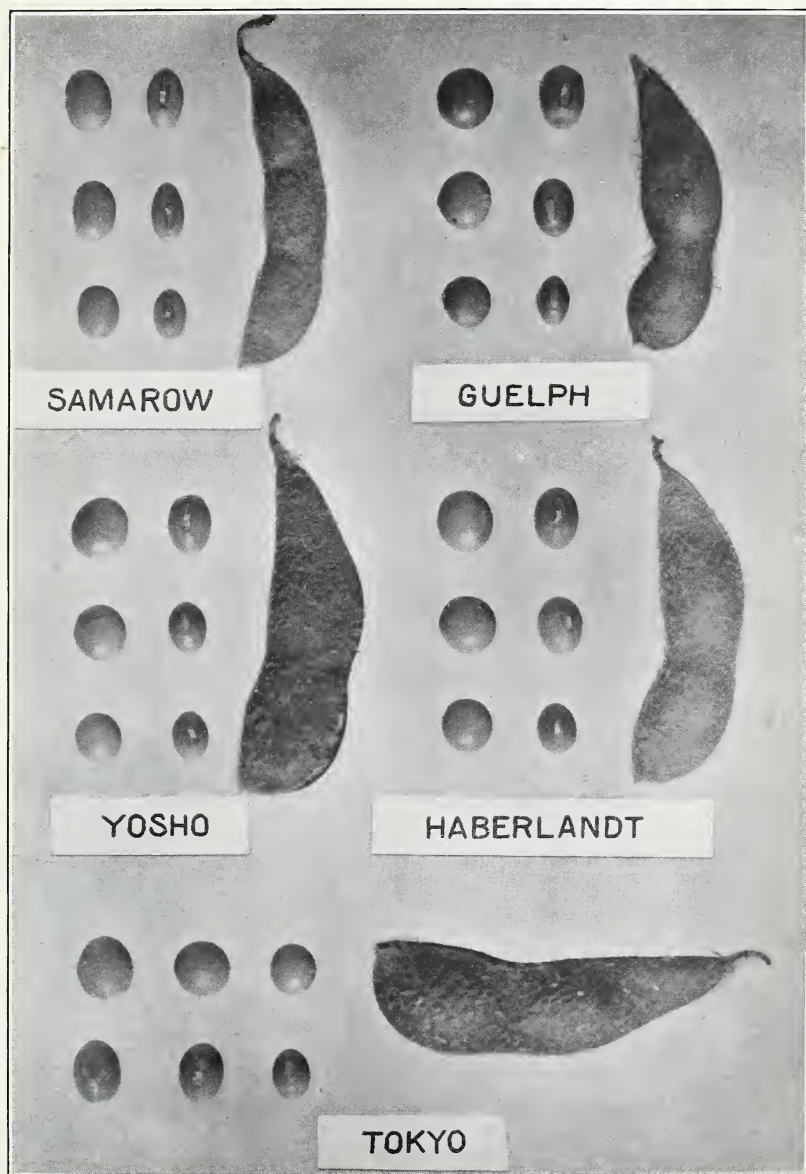




SEEDS AND PODS OF THE BROWN-SEEDED AND MOTTLED-SEEDED GROUPS.

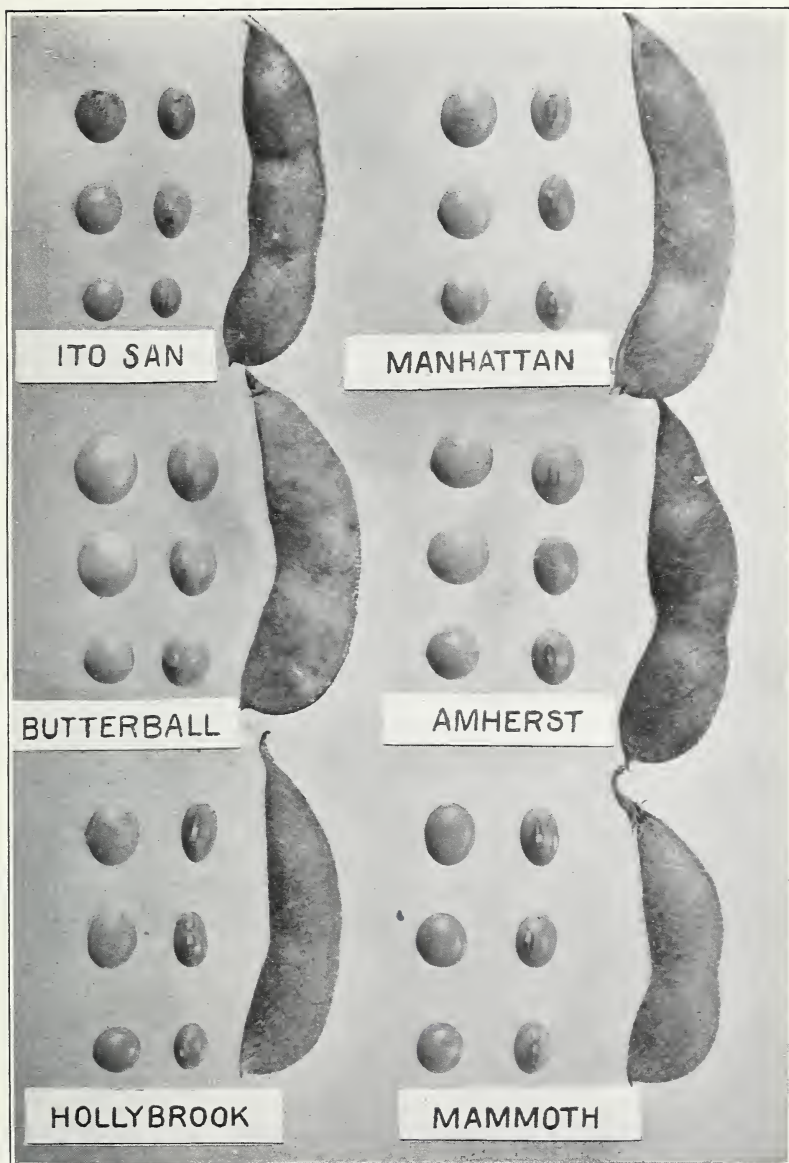






SEEDS AND PODS OF THE GREEN-SEEDED AND GREENISH-YELLOW-SEEDED GROUPS.





SEEDS AND PODS OF THE YELLOW-SEEDED GROUP.

